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A NOTE ON THE PSYCHOLOGY OF FISHES.

EDWARD THORNDIKE.

NUMEROUS facts witness in a vague way to the ability of fishes to profit by experience and fit their behavior to situations unprovided for by their innate nervous equipment. All the phenomena shown by fishes as a result of taming are, of course, of this sort. But such facts have not been exact enough to make clear the mental or nervous processes involved in such behavior, or simple enough to be available as demonstrations of such processes. It seemed desirable to obtain evidence which should demonstrate both the fact and the process of learning or intelligent activity in the case of fishes and demonstrate them so readily that any student could possess the evidence first-hand.

Through the kindness of the officials of the United States Fish Commission at Woods Holl, especially of the director, Dr. Bumpus, I was able to test the efficiency of some simple experiments directed toward this end. The common *Fun-
dulus* was chosen as a convenient subject, and also because of the neurological interest attaching to the formation of intelligent habits by a vertebrate whose fore-brain lacks a cortex.

The fishes studied were kept in an aquarium (about 4 feet long by 2 feet wide, with a water depth of about 9 inches) represented by Fig. 1. The space at one end, as represented by the lines in the figure, was shaded from the sun by a cover, and all food was dropped in at this end. Along each side of the aquarium were fastened simple pairs of cleats, allowing the experimenter to put across it partitions of wood, glass, or wire screening. One of these in position is shown in the figure by the dotted line. These partitions were made each with an opening, as shown in Fig. 2. If now we cause the fish to leave his shady corner and swim up to the sunny end by putting a

slide (without any opening) in behind him at *D* and moving it gently from *D* to *A* and then place, say slide *I*, across the aquarium at 1, we shall have a chance to observe the animal's behavior to good purpose.

This fish dislikes the sunlight and tries to get back to *D*. He reacts to the situation in which he finds himself by swimming against the screen, bumping against it here and there along the bottom. He may stop and remain still for a while. He will occasionally rise up toward the top of the water, especially while swimming up and down the length of the

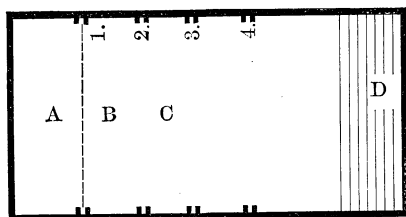


FIG. 1.

screen. When he happens to rise up to the top at the right-hand end, he has a clear path in front of him and swims to *D* and feels more comfortable.

If, after he has enjoyed the shade fifteen minutes or

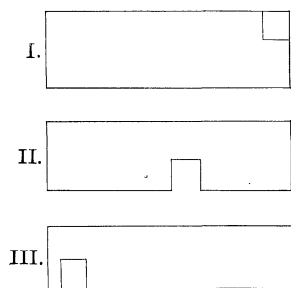


FIG. 2.

more, you again confine him in *A*, and keep on doing so six or eight times a day for a day or so, you will find that he swims against the screen less and less, swims up and down along it fewer and fewer times, stays still less and less, until finally his only act is to go to the right-hand side, rise up, and swim out. In correspondence with this change in behavior you will find

a very marked decrease in the time he takes to escape. The fish has clearly profited by his experience and modified his conduct to suit a situation for which his innate nervous equipment did not definitely provide. He has, in common language, *learned* to get out.

This particular experiment was repeated with a number of individuals. Another experiment was made, using three slides, *II*, *III*, and another, requiring the fish to find his way from *A* to *B*, *B* to *C*, and from *C* to *D*. The results of these and still others show exactly the same general mental process as does

the one described — a process which I have discussed at length elsewhere.¹

Whatever interest there is in the demonstration in the case of the bony fishes of the same process which accounts for so much of the behavior of the higher vertebrates may be left to the neurologists. The value of the experiment, if any, to most students will perhaps be the extreme simplicity of the method, the ease of administering it, and its possibilities. By using long aquaria one can study the formation of very complex series of acts and see to what extent any fish can carry the formation of such series. By proper arrangements the delicacy of discrimination of the fish in any respect may be tested. The artificiality of the surroundings may of course be avoided when desirable.

¹ Animal Intelligence; An Experimental Study of the Associative Processes in Animals. Monograph Supplement No. 8 to the *Psychological Review*, June, 1898.